ATTACHMENT J.4.66

OHIO AIR TOXICS POLICY (OATP)

OPTION A

REVIEW OF NEW SOURCES OF AIR TOXIC EMISSIONS

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REVIEW OF NEW SOURCES OF TOXIC EMISSIONS

Synopsis

The following is a summary of the Ohio Environmental Protection Agency (EPA) policy for the control of toxic air emissions.

1. Determine if a threshold limit value (TLV) exists for the specific compound which is emitted from the source.

2. Divide the TLV by ten to adjust the standard from the working population to the general public (TLV/10).

3. Adjust the standard to account for the duration of the exposure (operating hours of the source) of "X" hours per day and "Y" days per week from 8 hours per day and 5 days per week. This formula is used to obtain the Maximum Acceptable Ground-Level Concentration (MAGLC).

$$\left(\frac{TLV}{10} \times \frac{8}{X} \times \frac{5}{Y}\right) = 4\frac{TLV}{XY} = \text{MAGLC}$$

4. The Director may, on a case-by-case basis, accept an alternate analysis from a new source applicant.

Introduction

The basis for the air program's activities have been based upon the ambient air quality standards for "criteria pollutants." These standards, designed to protect health and welfare, have been established by U.S. EPA for the following six (6) pollutants:

1. Total suspended particulates,
2. Sulfur dioxide,
3. Carbon monoxide,
4. Nitrogen dioxide,
5. Ozone, and
6. Lead (Pb).

Emission limitations for new and existing sources have been established under the federal National Emission Standards for Hazardous Air Pollutants (NESHAPs) for the following pollutants:

1. Vinyl chloride,
2. Asbestos,
3. Beryllium,
4. Mercury,
5. Benzene, and
6. Arsenic (proposed).

The federal New Source Performance Standards (NSPS) also address several additional pollutants which are:

1. Fluorides,
2. Sulfuric acid mist,

3. Hydrogen sulfide, and

4. Reduced sulfur compounds.

For new sources, the Permit to Install rules require the application of Best Available Technology, and emissions of non-specified contaminants can be controlled through this mechanism. However, this level of review may not be adequate for toxic emissions. U.S. EPA has been slow to promulgate NESHAPs for additional pollutants. In order to assist in the review of new sources of toxic contaminants, the following policy has been developed by the Air Quality Modeling and Planning Section of the Division of Air Pollution Control.

Background and Rationale

The American Conference of Governmental Industrial Hygienists (ACGIH) has been involved with the safety aspects of work places where individuals may be exposed to varying levels of toxic substances. The ACGIH publishes and continuously updates a list of "Threshold Limit Values" (TLVs) for many substances. These TLVs represent maximum concentrations under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effects. Most of the TLVs refer to time-weighted average concentrations for a normal work day, with certain excursions within limits permissible during that time period, as long as the weighted average is not exceeded. However, for certain substances, there are levels that should not be exceeded at any time.

As outlined below, there are certain limitations and dangers in the literal application of TLVs for air pollution control purposes.

1. Threshold Limit Values are based on the information gathered in industrial/commercial settings, through experience from medical research and practice, from experimental human and animal studies, and also from a combination of these sources. Only in a few instances have the values been established firmly on a basis of examinations of human subjects correlated with extensive environmental observations.

2. The TLVs were determined for a population of workers who are essentially healthy and who fall within a "working age group" of about 17 to 65 years.

3. Synergistic effects of mixtures of substances are not considered in the development of TLVs, although the TLVs for mixtures can be calculated via the appropriate formula.

4. Individuals vary in sensitivity or susceptibility to toxic substances.

5. Often a single value is given for substances which occur in different forms and may have different toxicities.

6. For most contaminants, a worker during a normal work schedule (8 hours per day, 5 days per week) receives 40 hours of exposure per week with daily and weekend periods in which the body may rid itself of the accumulated substances before toxic levels are reached. For a person living continuously in an environment containing such substances, however, these recovery periods do not exist. Exposure to TLV levels may, therefore, subject the person to an unacceptably high risk of injury.

In setting ambient goals for toxic substances, two time periods must be considered.

1. Duration of Exposure - This is the amount of time a person spends in contact with a toxic substance. (In this application, it is assumed that a person may continuously be exposed to the specific contaminants during the operating hours of a source.)

2. Averaging Time - This time period is used to measure compliance with the standard.

For example, the OSHA TLVs have a maximum allowable duration of exposure of 8 hours/day and 40 hours/week, but an averaging time of 8 hours for determining compliance with the rules. Similarly, the ambient lead standard has a continuous duration of exposure, but a quarterly averaging time for determining compliance. Also, the ACGIH publishes acceptable ceiling concentration values within an 8-hour

workday, and acceptable maximum peak concentrations for a short period of time, in addition to the time-weighed 8-hour weekday.

Determination of Maximum Acceptable Ground-Level Concentration (MAGLC)

Taking into account the duration of exposure and averaging time, the following stepwise procedure should be used to determine the allowable ambient air concentration for a toxic substance:

1. Determine if a TLV exists for the specific compound which is emitted from the source.

2. Divide the TLV by ten (10) to adjust the standard from the working population to the general public (TLV/10).

3. Adjust the standard to account for the duration of the exposure (operating hours of the source) of "X" hours per day and "Y" days per week from 8 hours per day and 5 days per week.

$$\left(\frac{TLV}{10} \times \frac{8}{X} \times \frac{5}{Y}\right) = 4\,\frac{TLV}{XY}$$

4. The TLVs are based on an averaging time of 8 hours per day. The standard method of determining the ambient air quality effect of the source is through dispersion modeling. The most readily adaptable averaging time for dispersion models is generally one hour. The approvability of a source will be based on the

predicted one-hour averaging time (under worst-case meteorology) in comparison to the MAGLC obtained from Step 3. If the impact of the source is greater than the MAGLC, additional measures by the source will be necessary before the Permit to Install can be issued. Because no adjustment is made to the formula in Step 3, an additional safety factor of approximately 30% is produced (see Appendix A for the derivation of the 30% safety factor).

$$MAGLC = \frac{4\ TLV}{XY}$$

By using a factor of 10 in Step 2 and by decreasing the averaging time in Step 3, the TLV has been adjusted for the greater susceptibility of the general population in comparison to healthy workers.

The 8/X and the 5/Y multipliers in Step 3 are used to relate the exposure to longer than 40-hour time periods and ascertain that the individual's total exposure will be no greater than that allowed by the TLV.

For less than 40 hours per week of plant operation, the MAGLC formula will yield a value greater than the TLV/10. Although excursions of up to three times the TLV can be calculated in some cases, it does not appear reasonable to permit this situation for the general population. A condition on the formula is,

therefore, necessary to limit the allowable concentration to TLV/10 for operating times less than 40 hours per week.

Thus, from the above analysis, the derivation of the maximum acceptable ground-level concentration (maximum one hour average) beyond the plant boundary of a continuous emitting source would be:

$$\text{MAGLC} = \frac{\text{TLV}}{10} \times \frac{8 \text{ hours}}{24 \text{ hours}} \times \frac{5 \text{ days}}{7 \text{ days}} = \frac{\text{TLV}}{42}$$

An example of this procedure is contained in Appendix B.

The application of the policy is for use as a guideline in the review of new source applications. There may be cases where the TLV values are inappropriate for this type of application. The Director may consider, on a case-by-case basis, other data in the determination of a Maximum Acceptable Ground-Level Concentration from a new source.

Comparisons of MAGLC to National Ambient Air Quality Standards Values

In order to determine the relative stringency of this procedure, a comparison was made using this method with the National Ambient Air Quality Standards (NAAQS) for sulfur dioxide and ozone, and with the NESHAP for beryllium:

A. Sulfur Dioxide

For a continuously emitting sulfur dioxide source, the acceptable one-hour ground-level concentration would be:

$$MAGLC = \frac{(4)(TLV)}{(X)(Y)} = \frac{(4)(5\ ppm)}{(24\ hr/day)(7\ days/week)} = 0.12\ ppm$$

Under the NAAQS, the three-hour standard is 0.5 ppm, not to be exceeded more than once per year.

B. Ozone

For an intermittent ozone source operating three hours per day, five days per week, the allowable impact would be:

$$MAGLC = \frac{(TLV)}{(10)} = \frac{.1\ ppm}{10} = 0.01\ ppm$$

The NAAQS for ozone is 0.12 ppm one-hour average, not to be exceeded more than once per year over a three-year period.

APPENDIX A

The vertical (σ_z) and horizontal (σ_y) dispersion parameters utilized in most gaussian models were developed by Pasquill[1] and modified by Gifford[2]. Although the original experiments were based on a ten-minute sampling time, in practice, σ_y' and σ_z' values are considered to represent dispersion for a one-hour average. Due to wind direction fluctuations and variations in wind speed, it is necessary to adjust predictions which are greater than one-hour to account for these meteorological phenomena. To apply the predictions to longer than a one-hour period, the following equation is suggested by Turner[3]:

$$X_s = X_k \frac{(t_k)}{(t_s)}^p$$

Where

X_s is the concentration predicted over an averaging time t_s,

X_k is the concentration predicted over an averaging time t_k, and

p is a constant and should be between 0.17 and 0.2.

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[1] F. Pasquill, "The estimation of the dispersion of windborne material," Meteorological Magazine, Vol. 90, 1961, pp. 33-49.

[2] F.A. Gifford, "Use of routine meteological observations for estimating atmospheric diffusion," Nuclear Safety, Vol. 2, 1961 p. 47.

[3] D.B. Turner, "Workbook of Atmospheric Dispersion Estimates," Office of Air Programs Publication, No. AP-26, U.S. EPA, Research Triangle Park, North Carolina, 1970.

As shown below, applying this equation to the case of estimating an eight-hour average concentration, the one-hour predicted concentration should be reduced by 32%.

$$\frac{X_s}{X_k} = \frac{(t_k)^p}{(t_s)}$$

$$\frac{X_s}{X_k} = \frac{(1)}{(8)}^{0.185}$$

$$\frac{X_s}{X_k} = 0.680$$

By not allowing for this adjustment when reducing the averaging time from eight-hours to one-hour in step 4, an aditional safety factor of 32% is realized.

APPENDIX B

A new hazardous waste incinerator is proposing to burn sludge containing cadmium. The incinerator is equipped with a wet scrubber which is designed to remove 98% of the cadmium in the waste gas stream and will emit 4.6 pounds per hour of cadmium. The incinerator will operate 24 hours per day, 7 days per week.

The TLV for cadmium is 0.1 mg/m^3, and from Step 4, the maximum allowable ground-level concentration would be:

$$MAGLC = \frac{4(TLV)}{(X)(Y)} = \frac{(4)(0.05\ mg/m^3)}{(24\ hrs/day)(7\ days/week)} = 1.19 \times 10^{-3}\ mg/m^3$$

$$= 1.19 \times 10^{-6}\ g/m^3$$

From the PTMAX model, the maximum one-hour impact from the source is predicted to be 6.24×10^{-6} at 0.5 m/sec wind speed and F stability.

Since the predicted concentration is greater than the MAGLC of $1.19 \times 10^{-6}\ g/m^3$, the source will be required to develop a plan to reduce the ambient impact of the cadmium emissions.